

IN THE CLAIMS

Please amend the claims as follows.

1-2. (Canceled)

3. (Currently Amended) The interconnect of claim [[1]] 9, wherein the first metal layer layers is fabricated from copper.

4-5. (Canceled)

6. (Currently Amended) The interconnect of claim [[1]] 9, wherein each of the first metal layer and the second metal layer include a planar surface polished using chemical mechanical polishing.

7-8. (Canceled)

9. (Currently Amended) The interconnect of claim 1, An interconnect comprising:
an insulating layer having a top surface and a final thickness;
a trench in the insulating layer, the trench having a width and a depth across the width of
the trench, the depth being a substantially same depth across the width of the trench, the depth
being less than the final thickness and greater than a critical depth across the width of the trench,
wherein the critical depth includes a vertical thickness of a first barrier layer and a vertical
thickness of a seed layer and a vertical thickness of a first metal layer and a vertical thickness of
a second barrier layer;

the trench including within the trench and below a level coplanar with the top surface at
least and no more than the first barrier layer, the seed layer above the barrier layer, and the first
metal layer above the seed layer when the width of the trench is less than a first critical width
defined as twice the sum of a sidewall first barrier layer thickness, sidewall seed layer thickness,
and a sidewall first metal layer thickness; and

the trench including within the trench and below a level coplanar with the top surface at least the first barrier layer, the seed layer above the first barrier layer, the first metal layer above the seed layer, the second barrier layer above the first metal layer, and a second metal layer above the second barrier layer when the width of the trench is greater than a second critical width defined as twice the sum of the sidewall first barrier layer thickness, the sidewall seed layer thickness, the sidewall first metal layer thickness, and a sidewall second barrier layer thickness,
wherein at least the first metal layer couples a first logic device to a second logic device.

10. (Currently Amended) An interconnect comprising:

a first memory cell;

a second memory cell coupled to the first memory cell through the interconnect;

the interconnect having an insulating layer having a top surface and a final thickness and a trench in the insulating layer, the trench having a width and a depth across the width of the trench, the depth being a substantially same depth across the width of the trench, that is the depth being less than the final thickness and greater than a critical depth across the width of the trench, wherein the critical depth includes a vertical thickness of a first barrier layer and a vertical thickness of a seed layer and a vertical thickness of a first metal layer and a vertical thickness of a second barrier layer;

the trench including within the trench and below a level coplanar with the top surface at least and no more than the first barrier layer, the seed layer above the barrier layer, and the first metal layer above the seed layer when the width of the trench is less than a first critical width defined as twice the sum of a sidewall first barrier layer thickness, sidewall seed layer thickness, and a sidewall first metal layer thickness; and

the trench including within the trench and below a level coplanar with the top surface at least the first barrier layer, the seed layer above the first barrier layer, the first metal layer above the seed layer, the second barrier layer above the first metal layer, and a second metal layer above the second barrier layer when the width of the trench is greater than a second critical width defined as twice the sum of the sidewall first barrier layer thickness, the sidewall seed layer thickness, the sidewall first metal layer thickness, and a sidewall second barrier layer thickness.

11. (Previously Presented) An interconnect comprising:

an insulating layer having a top surface and a final thickness and including a first trench and a second trench;

the first trench including a first barrier layer and a seed layer therein, the first trench having a depth greater than a critical depth and a width less than twice a first sidewall thickness;

the second trench including the first barrier layer and the seed layer therein, the second trench having the depth of the first trench and a width greater than twice the first sidewall thickness and less than twice a sum of the first sidewall thickness and a second sidewall thickness;

a first metal layer above the first trench and the second trench; and

a second metal layer above the second trench;

wherein the critical depth includes a vertical thickness of the first barrier layer and a vertical thickness of the seed layer and a vertical thickness of a metal layer and a vertical thickness of a second barrier layer.

12. (Original) The interconnect of claim 11, wherein the first metal layer above the first trench couples a first integrated circuit device to a second integrated circuit device in a memory module.

13. (Original) The interconnect of claim 11, wherein the first metal layer above the first trench couples a first integrated circuit device to a second integrated circuit device in a logic module.

14. (Canceled)

15. (Previously Presented) An interconnect comprising:

an insulating layer having a top surface and a final thickness and including a first trench and a second trench;

the first trench including a first barrier layer and a seed layer therein, the first trench having a top and a depth greater than a critical depth, and a width less than a sidewall width of a first metal;

the second trench including the first barrier layer and the seed layer therein, the second trench having a depth greater than the critical depth, and a width greater than twice the sidewall width of the first barrier layer and the seed layer and the first metal, and less than twice a sidewall width of a second metal; and

a first and a second metal deposited on the first trench and the second trench, the second metal is planarized to the top of the first trench.

16. (Original) The interconnect of claim 15, wherein the second metal comprises Al.

17. (Original) The interconnect of claim 15, wherein the second metal is planarized by chemical mechanical polishing.

18-22. (Canceled)

23. (Previously Presented) An interconnect comprising:

a first trench including a first barrier layer and a seed layer and a metal layer therein, the first trench having a width; and

a second trench having a depth greater than a critical depth and a second width greater than the width, the second trench having a plurality of metal layers and at least one of the plurality of metal layers is coupled to the metal layer;

wherein the critical depth includes a vertical thickness of the first barrier layer and a vertical thickness of the seed layer and a vertical thickness of a first metal layer of the plurality of metal layers and a vertical thickness of a second barrier layer.

24. (Original) The interconnect of claim 23, further comprising a wire bond coupling a conductive material to at least one of the plurality of metal layers.

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25. (Original) The interconnect of claim 24, wherein at least one of the plurality of metal layers is aluminum.

26. (Previously Presented) An interconnect comprising:

a first trench including a first barrier layer and a seed layer and a copper layer therein, the first trench having a depth greater than a critical depth; and

a second trench wider than the trench, and the second trench including the first barrier layer and the seed layer and the copper layer and having a plurality of metal layers therein, wherein at least one of the plurality of layers is an aluminum layer, and at least one of the plurality of metal layers is coupled to the copper layer;

wherein the critical depth includes a vertical thickness of the first barrier layer and a vertical thickness of the seed layer and a vertical thickness of a metal layer and a vertical thickness of a second barrier layer.

27. (Original) The interconnect of claim 26, wherein the aluminum layer is an aluminum alloy layer.

28. (Previously Presented) The interconnect of claim 26, wherein at least one of the plurality of metal layers is a copper alloy layer.

29. (Original) The interconnect of claim 26, wherein the aluminum layer is wire-bonded to a conductive material.

30. (Original) The interconnect of claim 29, wherein the conductive material is gold.

31-47. (Canceled)

48. (Previously Presented) An interconnect comprising:

a first trench including a first barrier layer and a seed layer therein, the first trench having a depth less than a critical depth and a width less than a critical width and a metal layer; and

a second trench having a depth greater than the critical depth;

a plurality of metal layers above the second trench, at least one of the plurality of metal layers is coupled to the metal layer, wherein at least one of the plurality of metal layers is capable of forming a highly reliable eutectic bond to a conductive material;

wherein the critical depth includes a vertical thickness of the first barrier layer and a vertical thickness of the seed layer and a vertical thickness of a metal layer and a vertical thickness of a second barrier layer, and wherein the critical width includes twice the sum of the first barrier layer sidewall thickness and the seed layer sidewall thickness and the metal layer sidewall thickness.

49. (Original) The interconnect of claim 48, wherein the metal layer is copper.

50. (Previously Presented) The interconnect of claim 49, wherein at least one of the plurality of metal layers is aluminum.

51. (Original) The interconnect of claim 48, wherein at least one of the plurality of metal layers is an aluminum alloy.

52. (Previously Presented) An interconnect comprising:

a first trench including a first barrier layer, a seed layer, and a first metal layer therein, the first trench having a depth greater than a critical depth;

a second trench including the first barrier layer, the seed layer and a plurality of metal layers therein, at least one of the plurality of metal layers is coupled to the first metal layer, wherein only one of the plurality of metal layers is capable of forming a highly reliable eutectic bond to a gold wire; and

wherein the critical depth includes a vertical thickness of the first barrier layer and a vertical thickness of the seed layer and a vertical thickness of the first metal layer and a vertical thickness of a second barrier layer.

AMENDMENT AND RESPONSE UNDER 37 CFR § 1.116 – EXPEDITED PROCEDURE

Serial Number: 09/388,567

Filing Date: September 2, 1999

Title: LOCAL MULTILAYERED METALLIZATION

53. (Original) The interconnect of claim 52, wherein the second trench has a depth greater than the critical depth.

54. (Previously Presented) A conductive structure comprising:

a first trench including a first barrier layer, a seed layer, and a first metal layer therein, the first trench having a width, and a depth greater than a critical depth in every part of the first trench; and

a second trench including the first barrier layer and the seed layer therein and the second trench having a width, a depth greater than the critical depth in every part of the second trench, and a plurality of metal layers therein, the width of the second trench is greater than the width of the first trench, and at least one of the plurality of the metal layers is electrically coupled to the first metal layer;

wherein the critical depth includes a vertical thickness of the first barrier layer and a vertical thickness of the seed layer and a vertical thickness of the first metal layer and a vertical thickness of a second barrier layer.

55-56. (Canceled)

57. (Previously Presented) A conductive structure comprising:

a narrow trench including a first barrier layer, a seed layer and a first metal layer therein, the narrow trench having a first depth greater than a critical depth; and

a wide trench having a plurality of metal layers therein and a second depth equal to the first depth, wherein at least one of the plurality of metal layers is coupled to the first metal layer;

wherein the critical depth includes a vertical thickness of the first barrier layer and a vertical thickness of the seed layer and a vertical thickness of the first metal layer and a vertical thickness of a second barrier layer.

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58. (Previously Presented) An interconnect comprising:

a trench including a first barrier layer; a seed layer, and a metal layer therein, the trench having a width less than a critical width, a first depth greater than a critical depth in every part of the trench; and

a wide depression having a second width greater than the critical width, a second depth equal to the first depth, and a plurality of metal layers, wherein at least one of the plurality of metal layers is coupled to the metal layer;

wherein the critical width includes twice the sum of the first barrier layer sidewall thickness and the seed layer sidewall thickness and the metal layer sidewall thickness;

wherein the critical depth includes a vertical thickness of the first barrier layer and a vertical thickness of the seed layer and a vertical thickness of the metal layer and a vertical thickness of a second barrier layer.

59-80. (Canceled)

81. (Currently Amended) The interconnect of claim [[1]] 9, wherein the second metal layer includes aluminum.

82. (Currently Amended) The interconnect of claim [[1]] 9, wherein the second metal layer is deposited on the second barrier layer to a depth sufficient to wire-bond the second metal layer to a gold wire.

83. (Currently Amended) The interconnect of claim 1, An interconnect comprising:

an insulating layer having a top surface and a final thickness;

a trench in the insulating layer, the trench having a width and a depth across the width of the trench, the depth being a substantially same depth across the width of the trench, the depth being less than the final thickness and greater than a critical depth across the width of the trench,
wherein the critical depth includes a vertical thickness of a first barrier layer and a vertical thickness of a seed layer and a vertical thickness of a first metal layer and a vertical thickness of a second barrier layer;

the trench including within the trench and below a level coplanar with the top surface at least and no more than the first barrier layer, the seed layer above the barrier layer, and the first metal layer above the seed layer when the width of the trench is less than a first critical width defined as twice the sum of a sidewall first barrier layer thickness, sidewall seed layer thickness, and a sidewall first metal layer thickness;

the trench including within the trench and below a level coplanar with the top surface at least the first barrier layer, the seed layer above the first barrier layer, the first metal layer above the seed layer, the second barrier layer above the first metal layer, and a second metal layer above the second barrier layer when the width of the trench is greater than a second critical width defined as twice the sum of the sidewall first barrier layer thickness, the sidewall seed layer thickness, the sidewall first metal layer thickness, and a sidewall second barrier layer thickness, and

including a passivation layer above the top surface of the insulating layer and above at least a portion of the trench, the passivation layer including an opening exposing the second metal layer.

84. (Previously Presented) The interconnect of claim 83, including a wire bond attached to the second metal layer through the opening in the passivation layer.

85. (Previously Presented) The interconnect of claim 84, wherein the wire bond includes a gold conductor.